

# Ichthyofaunal survey of stretches of the Guariba and Roosevelt Rivers, in Guariba State Park and Guariba Extractive Reserve, Madeira River basin, Amazonas, Brazil

Wellington Silva Pedroza\*, Frank Raynner V. Ribeiro, Túlio Franco Teixeira, Willian M. Ohara and Lúcia H. Rapp Py-Daniel

Instituto Nacional de Pesquisas da Amazônia, Programa de Coleções e Acervos, Coleção de Peixes. Avenida André Araújo, 2936, Petrópolis. CEP 69011-970. Manaus, AM, Brazil.

\* Corresponding author. E-mail: [well\\_pedroza@hotmail.com](mailto:well_pedroza@hotmail.com)

**ABSTRACT:** The fishes presented herein were collected in small streams, in channel of lagoons and in the main channel of the Guariba River, as well as in one tributary of the right bank of the Roosevelt River, both clear-water tributaries of Aripuanã River, Madeira River basin. Field work was carried out in November 2008, during the low water season. Sampling resulted in 3924 specimens belonging to 160 species distributed in 34 families, and seven orders. Eight species are recognized as new, two of which were recently described. This study represents the first fish survey for the region and will certainly provide valuable information for future studies and maintenance of the poorly known fish diversity of these two conservation areas.

## INTRODUCTION

The Guariba and Roosevelt Rivers are clear water tributaries of the right-bank of the Aripuanã River. These rivers are important tributaries of the east side of the Madeira River basin. Their headwaters are located in the Brazilian Shield flowing down over Cambrian rocks, geologically older and more eroded than the Andean components of the Madeira basin. Currently, nine different protected areas, created in the southeast of Amazonas state, comprise the Mosaic of Apuí, comprehending the Guariba and Sucunduri State Parks, Aripuanã and Bararati Sustainable Development Reserves, Guariba Extractive Reserve, and Manicoré, Aripuanã, Sucunduri and Apuí State Forests.

The Mosaic of Apuí, located close to Apuí and Novo Aripuanã cities, has approximately 2.5 million hectares and is composed by two biomes: a tropical rainforest and natural savanna-like Cerrado. Its creation is an important conservation strategy to contain the spread of the arc of deforestation at the south and eastern areas in the Amazon and also to minimize the loss of biodiversity caused by unsustainable practices (logging, monoculture, land grabbing and cattle).

The present work is the partial result of a governmental effort to fund inventories on protected areas. In general, these areas are created due to high biodiversity estimates as well as high levels of environmental threats. The possibility to reinforce their biological importance through inventories will certainly provide valuable information for the future and maintenance of this biodiversity, adding credibility to theoretical estimates.

Thus, this study provides the first and single list of fish species from Guariba State Park and Guariba Extractive Reserve, Madeira River basin, Amazonas state, Brazil.

## MATERIAL AND METHODS

Field work was carried out during November 2008, on the stretches of the drainages of the Guariba and Roosevelt Rivers, delimited by the boundaries of the Guariba State Park and Guariba Extractive Reserve (Figure 1). These two units cover an approximate area of 222,800,00 ha, with different kind of floristic formations (even a savannah vegetation typical of Amazonian enclave - Ab'Saber, 2003) and rocky soils.

From the total of collection sites (13, see Table 1), including river main channel, streams and lakes, 10 are located in the Guariba drainage and three in the Roosevelt drainage. This asymmetry in sampling was due to difficulties to reach the Roosevelt River. Thus, analyses of similarity, richness and others between the two rivers were not done.

The collections were conducted using the following gears: seine-nets (11 meters long, 3 mm mesh), hand-nets (3 mm mesh), casting-nets (3 cm mesh) and gill-nets (2.5; 3; 4; 5; 7; 8; 10; 11 and 14 cm stretched mesh). When employed, gill-nets were set at afternoon and left for six hours (from 16h to 22h) with a review at nightfall (18h). The high abundance of crocodilians was the precluded longer exposition. Hand nets were employed at small streams by the morning, in a previously established stretch of 150 meters along the length of the stream, and then exploited by two collectors that worked on upstream direction during a period of two and half hours. Seine-nets were employed at the same stretch of stream, always after hand-net usage, comprising one seining for each stretch of 50 meters. To determine the values of the attributes of the community only data collected from the first 50 m (worked during one hour) were used, following the methodology proposed by the Projeto Igarapés (Projeto Igarapés 2007), with a modification on sampling time. Data from the remaining 100 m, as data on catches on gill-net were only used in the inventory.



Collected individuals were anesthetized with benzocaine diluted in water and immediately preserved in 10% buffered formalin. The collected material was brought from field and sorted at the fish collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), where it was transferred to 70% ethanol. Species identification was based on dichotomic keys, descriptions of fish species and fish-taxonomy catalogues (e.g. Géry 1977; Isbrücker 1981; Vari 1983, 1989; Santos *et al.* 2004; Burguess 1989; Buckup 1993; Mago-Leccia 1994; Kullander and Nijssen 1989; Glaser *et al.* 1996; Reis 1997; Ferreira *et al.* 1998; Reis *et al.* 2003; Buckup *et al.* 2007; Ferraris 2007) and with additional assistance of fish specialists from INPA.

Alpha diversity was estimated by Shannon-Wiener index ( $H'$ ) (Shannon and Weaver, 1963) and equitability ( $J_s$ ) was calculated according to Pielou (1966). Voucher specimens were deposited in the INPA Fish collection, Brazil. The classification of fishes followed Reis *et al.* (2003), except the allocation of the genus *Chalceus* in the family Alestidae, which follows Zanata and Vari (2005).

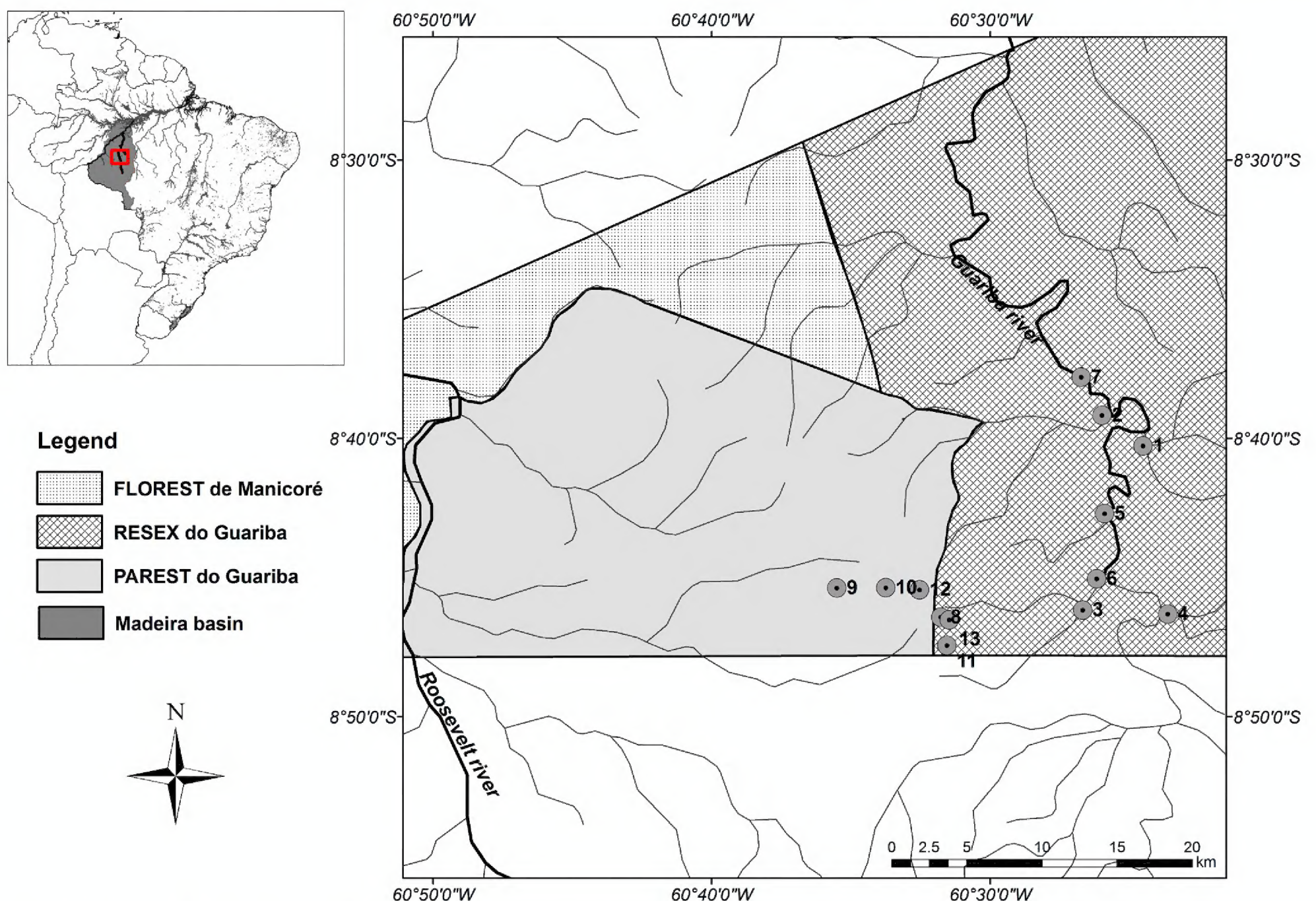
## RESULTS AND DISCUSSION

A total of 3924 specimens belonging to 160 species, distributed in 34 families and seven orders, were collected (Table 2). The Guariba River drainage produced 3230 specimens (82.3%), representing 154 species (96.5%), distributed in 34 families (100%) and seven orders; while 694 specimens (17.7%) representing 25 species (15.7%) distributed in 10 families (29.4%) and six orders, were collected in the Roosevelt River drainage.

In the Guariba River drainage, Characiformes was the most species-rich taxon with 89 species (57.7% of the total species richness), followed by Siluriformes with 44 species (28.5%), Perciformes with 12 species (7.7%), and Gymnotiformes with six species (3.8%). In the Roosevelt River Characiformes was also the most species-rich with 15 species (60% of the total species richness), followed by Gymnotiformes with four species (16%), and Siluriformes and Perciformes both with two species each (1.6%).

In the Guariba River drainage, Osteoglossiformes, Cyprinodontiformes, and Synbranchiformes were represented by only one species each and represented less than 1% of the total species richness. As observed by several authors (e.g. Lowe-McConnell 1987; Reis *et al.* 2003; Buckup *et al.* 2007) Characiformes and Siluriformes were the dominant taxa in Guariba River. Since only three tributaries were sampled in the Roosevelt River drainage, we believe that sampling in areas, such as the main river channel, lakes and larger tributaries of this river would reveal the same pattern.

In the Guariba River drainage the most species-rich family was Characidae, with 52 species (33.7% of the total species caught in this drainage), followed by Loricariidae, with 15 species (9.4%), comprising approximately 43.1% of the total. Other well-represented families were Cichlidae, with 10 species (6.3%), Anostomidae, with seven species (4.4%), Crenuchidae and Pimelodidae, both with six species (7.6%). In the Roosevelt River the family Characidae was also the richest with 11 species (44%), comprising alone almost half of the total species collected.



**FIGURE 1.** Study area indicating the stretch studied in the Guariba and Roosevelt Rivers, Guariba State Park and Guariba Extractive Reserve Amazonas State, Brazil. FLOREST (Floresta Estadual) de Manicoré - Manicoré State Forest; RESEX (Reserva Extrativista) do Guariba - Guariba Extractive Reserve; PAREST (Parque Estadual) do Guariba - Guariba State Park



Remaining families were either represented by one or two species each. As observed by Carmassi *et al.* (2009), several studies involving freshwater Neotropical ichthyofauna inventories have demonstrated a high contribution of the species belonging to these families.

It was observed that the sampling sites 1, 2, 3 and 4 presented the highest values of richness, diversity and equitability. These points are located near the mouth of the streams and run over plain land, allowing more horizontal migration. The lowest values of richness, diversity and equitability were presented by sampling sites located near the headwaters, including the three streams sampled in the Roosevelt drainage (Table 3). According to Garutti (1988) and Casatti (2005), species richness tends to increase from headwaters toward the mouth of the streams, following a gradient increase of microhabitats.

The literature on the ichthyofauna of the Madeira River basin covers some of its important tributaries, such as Mamoré, Madeirinha, Roosevelt, Jatuarana and lower Aripuanã Rivers (Lauzanne and Loubens 1985; Camargo and Giarizzo 2007; Rapp Py-Daniel *et al.* 2007). However, the lack of studies on the fish fauna in the Guariba River basin is the main reason of several uncertain identifications (“cf” and “sp”). Taxonomic revisions would certainly benefit by including the morphotypes of these drainages.

Eight species were recognized as new (two of which recently described), five belong to Siluriformes (*Ituglanis* sp., *Paravandellia* sp., *Paracanthopoma* sp. 1, *Pharacanthopoma* sp. 2, and *Nemuroglanis furcatus* Ribeiro, Pedroza and Rapp Py-Daniel, 2011), and three to Characiformes (*Phenacogaster* sp., *Pyrrhulina* sp.

and *Jupiaba citrina* Zanata and Ohara, 2009 ). Among the five new species of Siluriformes, four belong to the family Trichomycteridae, with two sympatric species of the genus *Paracanthopoma*. Several specimens were discriminated, with the use of “aff.” or “cf.”, which indicates that the number of new species may be higher. All newly recognized Siluriformes species were sampled only in the Guariba drainage, whereas the new taxa of Characiformes were found in both drainages. All new species found in this work are only known from these localities. However the record of a new species in a certain locality is not an evidence of endemism of the species (Zuanon *et al.* 2004). Certainly, more sampling sites in the Madeira River basin, as well as in the Amazon basin, would produce more taxonomic novelties and valuable information about the real distribution of the species collected in these drainages. It is also very likely that further inventories might produce a larger number of species.

The number of species that compose the fish fauna of the sampled area is probably greater than those recorded at the moment. The implementation of techniques of collection not used in this study (*e.g.* bottom trawl, electric fishing) may increase the number of species, mainly those belonging to the orders Siluriformes and Gymnotiformes, since these share important adaptations for environments of rapids and low luminosity (Lundberg *et al.* 1987; Santos and Ferreira 1999; Cox-Fernandes *et al.* 2004), being commonly found in deeper portions of the river (Cox-Fernandes *et al.* 2004). Because it is an ichthyologically unexplored area, all species found represent new records.

**TABLE 1.** Sampling points in the Guariba and Roosevelt Rivers, Madeira River basin. CU = conservation unit: RESEX = Guariba Extractive Reserve; PAREST = Guariba State Park.

| POINT | LOCAL               | DRAINAGE  | GEOGRAPHICAL COORDINATES | CU     |
|-------|---------------------|-----------|--------------------------|--------|
| 1     | Bom Jesus stream    | Guariba   | 08°40'16" S, 60°24'30" W | RESEX  |
| 2     | Santa Isabel stream | Guariba   | 08°39'11" S, 60°25'58" W | RESEX  |
| 3     | das Araras stream   | Guariba   | 08°46'10" S, 60°26'40" W | RESEX  |
| 4     | Pajurá stream       | Guariba   | 08°46'19" S, 60°23'37" W | RESEX  |
| 5     | lagoon channel      | Guariba   | 08°42'42" S, 60°25'53" W | RESEX  |
| 6     | river channel       | Guariba   | 08°45'03" S, 60°26'10" W | RESEX  |
| 7     | river channel       | Guariba   | 08°37'49" S, 60°26'44" W | RESEX  |
| 8     | unnamed stream      | Guariba   | 08°46'26" S, 60°31'46" W | RESEX  |
| 9     | unnamed stream      | Roosevelt | 08°45'23" S, 60°35'30" W | PAREST |
| 10    | stream Cujubim      | Roosevelt | 08°45'22" S, 60°33'44" W | PAREST |
| 11    | unnamed stream      | Guariba   | 08°47'26" S, 60°31'32" W | RESEX  |
| 12    | unnamed stream      | Roosevelt | 08°45'26" S, 60°32'32" W | PAREST |
| 13    | unnamed stream      | Guariba   | 08°46'31" S, 60°31'28" W | RESEX  |



**TABLE 2.** Taxonomic list of the species captured in the Guariba and Roosevelt Rivers, Madeira River basin, including the number of specimens of fish collected in each river and INPA catalogued numbers. G = Guariba River; R = Roosevelt River; T = Total.

| TAXA   | VULGAR NAME                 | G   | R  | T   | INPA LOT #                               |
|--|-----------------------------|-----|----|-----|--|
| OSTEOGLOSSIFORMES  |                             |     |    |     |  |
| Osteoglossidae   |                             |     |    |     |  |
| <i>Osteoglossum bicirrhosum</i> (Cuvier, 1829)                 | Aruanã; Sulamba             | 2   | -  | 2   | 33612; 33710                             |
| CHARACIFORMES  |                             |     |    |     |  |
| Parodontidae   |                             |     |    |     |  |
| <i>Apareiodon</i> sp.1   | Piaba                       | 10  | -  | 10  | 33683                                    |
| <i>Apareiodon</i> sp.2   | Piaba                       | 6   | -  | 6   | 33692                                    |
| Curimatidae  |                             |     |    |     |  |
| <i>Curimata knerii</i> (Steindachner, 1876)                    | Branquinha                  | 3   | -  | 3   | 33639                                    |
| <i>Cyphocharax notatus</i> (Steindachner, 1908)                | Branquinha                  | 1   | -  | 1   | 33458                                    |
| <i>Cyphocharax spiluropsis</i> (Eigenmann and Eigenmann, 1889) | Branquinha                  | 1   | -  | 1   | 33448                                    |
| <i>Steindachnerina fasciata</i> (Vari and Géry, 1985)          | Branquinha                  | 2   | -  | 2   | 33690                                    |
| Prochilodontidae   |                             |     |    |     |  |
| <i>Prochilodus nigricans</i> Agassiz, 1829                     | Curimatã; Curimatá; Curimba | 1   | -  | 1   | 33708                                    |
| Anostomidae  |                             |     |    |     |  |
| <i>Anostomus ternetzi</i> Fernández-Yépez, 1949                | Cabeça-para-baixo           | 3   | -  | 3   | 32972                                    |
| <i>Leporinus brunneus</i> Myers, 1950                          | Aracu; Piau                 | 3   | -  | 3   | 33662; 33668                             |
| <i>Leporinus cylindriformis</i> Borodin, 1929                  | Aracu; Piau                 | 2   | -  | 2   | 33659                                    |
| <i>Leporinus fasciatus</i> (Bloch, 1794)                       | Aracu-flamengo              | 1   | -  | 1   | 33617                                    |
| <i>Leporinus friderici</i> (Bloch, 1794)                       | Aracu-cabeça-gorda          | 4   | -  | 4   | 33608; 33631; 33667                      |
| <i>Leporinus granti</i> Eigenmann, 1912                        | Aracu-cabeça-gorda          | 1   | -  | 1   | 33661                                    |
| <i>Pseudanos trimaculatus</i> (Kner, 1858)                     | Aracu                       | 2   | -  | 2   | 32971; 33469                             |
| Chilodontidae  |                             |     |    |     |  |
| <i>Caenotropus labyrinthicus</i> (Kner, 1858)                  | Cabaça-dura                 | 4   | -  | 4   | 33622; 33716                             |
| <i>Chilodus punctatus</i> Müller and Troschel, 1844            | Cabeça-para-baixo           | 3   | -  | 3   | 33652                                    |
| Crenuchidae  |                             |     |    |     |  |
| <i>Characidium</i> sp.1  | Mocinha                     | 10  | -  | 10  | 33010; 33464; 33491; 33505; 33558        |
| <i>Characidium</i> sp.2  | Mocinha                     | 137 | -  | 137 | 33011; 33477; 33492; 33504               |
| <i>Elachocharax pulcher</i> Myers, 1927                        | -                           | 28  | -  | 28  | 32986; 33456; 33526                      |
| <i>Microcharacidium</i> aff. <i>eleotrioides</i>               | Mocinha                     | 50  | -  | 50  | 32991; 33475; 33503; 33578               |
| <i>Microcharacidium</i> aff. <i>weitzmani</i>                  | Mocinha                     | 43  | -  | 43  | 33487                                    |
| <i>Odontocharacidium</i> sp.                                   | Mocinha                     | 1   | -  | 1   | 33520                                    |
| Hemiodontidae  |                             |     |    |     |  |
| <i>Bivibranchia</i> sp.  | Voador                      | 4   | -  | 4   | 33687                                    |
| <i>Hemiodus</i> aff. <i>unimaculatus</i>                       | Charuto; Orana              | 1   | -  | 1   | 33721                                    |
| <i>Hemiodus amazonum</i> (Humboldt, 1821)                      | Charuto; Orana              | 1   | -  | 1   | 33660                                    |
| Alestidae  |                             |     |    |     |  |
| <i>Chalceus epakros</i> Zanata and Toledo-Piza, 2004           | Arari                       | 2   | -  | 2   | 33627                                    |
| Characidae   |                             |     |    |     |  |
| <i>Amazonsprattus scintilla</i> Roberts, 1984                  | Piaba                       | 26  | -  | 26  | 32985; 33533; 33686                      |
| <i>Aphyocharax</i> sp.   | Piaba                       | 53  | -  | 53  | 33699                                    |
| <i>Astyanax</i> sp.  | Lambari                     | 45  | -  | 45  | 32993; 33689                             |
| <i>Brycon falcatus</i> Müller and Troschel, 1844               | Matrinxã                    | 1   | -  | 1   | 33630                                    |
| <i>Brycon pesu</i> Müller and Troschel, 1845                   | Piabão                      | 2   | -  | 2   | 33638; 33672                             |
| <i>Bryconops caudomaculatus</i> (Günther, 1864)                | Piaba; Piquirão             | 20  | 1  | 21  | 32982; 33450; 33497; 33508; 33598; 33696 |
| <i>Catoprion mento</i> (Cuvier, 1819)                          | Pacu-piranha                | 3   | -  | 3   | 33619; 33717                             |
| <i>Creagrutus anary</i> Fowler, 1913                           | Piaba                       | 132 | 26 | 158 | 33008; 33457; 33499; 33517; 33590; 33693 |
| <i>Cynopotamus amazonus</i> (Günther, 1868)                    | Piaba                       | 2   | -  | 2   | 33621; 33723                             |
| <i>Hemigrammus</i> cf. <i>analís</i>                           | Piaba                       | 2   | -  | 2   | 32996                                    |
| <i>Hemigrammus</i> cf. <i>belottii</i>                         | Piaba                       | 7   | 4  | 11  | 33476; 33542; 33675; 33748               |
| <i>Hemigrammus</i> cf. <i>vorderwinkleri</i>                   | Piaba                       | 6   | -  | 6   | 32989                                    |
| <i>Hyphessobrycon copelandi</i> Durbin, 1908                   | Piaba                       | 3   | -  | 3   | 33575                                    |



TABLE 2. CONTINUED.

| TAXA   | VULGAR NAME       | G   | R  | T   | INPA LOT #                        |
|--|-------------------|-----|----|-----|-----------------------------------|
| <i>Hyphessobrycon</i> aff. <i>agulha</i>                       | Piaba             | 96  | 1  | 97  | 33466; 33483; 33534; 33551; 33564 |
| <i>Hyphessobrycon</i> sp.                                      | Piaba             | 3   | -  | 3   | 33532                             |
| <i>Jupiaba citrina</i> Zanata and Ohara, 2009                  | Piaba             | 7   | 17 | 24  | 32026; 32027; 32028               |
| <i>Jupiaba zonata</i> (Eigenmann, 1908)                        | Piaba             | 5   | -  | 5   | 33574                             |
| <i>Knodus</i> cf. <i>heteresthes</i>                           | Piaba             | 89  | -  | 89  | 32999; 33452                      |
| <i>Metynnis</i> sp.  | Pacu-marreca      | 2   | -  | 2   | 33614                             |
| <i>Microchemobrycon callops</i> Böhlke, 1953                   | Piaba             | 10  | -  | 10  | 32984; 33701                      |
| <i>Microchemobrycon casiquiare</i> Böhlke, 1953                | Piaba             | 41  | -  | 41  | 33009; 33454; 33523; 33572; 33702 |
| <i>Moenkhausia oligolepis</i> (Günther, 1864)                  | Piaba             | 2   | 21 | 23  | 33455; 33556; 33585               |
| <i>Moenkhausia collettii</i> (Steindachner, 1882)              | Piaba             | 107 | -  | 107 | 32995; 33460; 33571; 33697        |
| <i>Moenkhausia comma</i> Eigenmann, 1908                       | Piaba             | -   | 4  | 4   | 33588                             |
| <i>Moenkhausia cotinho</i> Eigenmann, 1908                     | Piaba             | 5   | -  | 5   | 33688                             |
| <i>Moenkhausia</i> cf. <i>lepidura</i>                         | Piaba             | 23  | -  | 23  | 33000; 33459; 33576; 33703        |
| <i>Moenkhausia</i> sp.1  | Piaba             | 3   | -  | 3   | 33685                             |
| <i>Moenkhausia</i> sp.2  | Piaba             | 479 | -  | 479 | 33763                             |
| <i>Myleus asterias</i> (Müller and Troschel, 1844)             | Pacu              | 4   | -  | 4   | 33669; 33727                      |
| <i>Myleus rubripinnis</i> (Müller and Troschel, 1844)          | Pacu              | 7   | -  | 7   | 33611; 33616; 33726               |
| <i>Myleus schomburgkii</i> (Jardine and Schomburgk, 1841)      | Pacu-jumento      | 6   | -  | 6   | 33610; 33615; 33625               |
| <i>Phenacogaster beni</i> Eigenmann, 1911                      | Piaba             | 1   | 5  | 6   | 33750; 33756                      |
| <i>Phenacogaster</i> sp. n.                                    | Piaba             | 38  | 36 | 74  | 33752; 33753; 33754               |
| <i>Phenacogaster</i> sp.                                       | Piaba             | 4   | -  | 4   | 33749; 33755                      |
| <i>Poptella compressa</i> (Günther, 1864)                      | Matupiri; Pataca  | -   | 6  | 6   | 33592                             |
| <i>Pristella</i> sp.   | Piaba             | 19  | -  | 19  | 32977; 33573                      |
| <i>Pristobrycon striolatus</i> (Steindachner, 1908)            | Piranha           | 13  | -  | 13  | 33725                             |
| <i>Roeboides affinis</i> (Günther, 1868)                       | Zé-do-ó           | 4   | -  | 4   | 33722                             |
| <i>Serrasalmus eigenmanni</i> Norman, 1929                     | Piranha-branca    | 4   | -  | 4   | 33634                             |
| <i>Serrasalmus humeralis</i> Valenciennes, 1850                | Piranha           | 3   | -  | 3   | 33719                             |
| <i>Serrasalmus manueli</i> (Fernández-Yépez and Ramírez, 1967) | Piranha           | 2   | -  | 2   | 33613; 33657                      |
| <i>Serrasalmus rhombeus</i> (Linnaeus, 1766)                   | Piranha-preta     | 9   | -  | 9   | 33633; 33650; 33718               |
| <i>Serrasalmus</i> sp.1 (juvenile)                             | Piranha           | 2   | -  | 2   | 33463                             |
| <i>Serrasalmus</i> sp.2 (juvenile)                             | Piranha           | 1   | -  | 1   | 33474                             |
| <i>Tetragonopterus argenteus</i> Cuvier, 1816                  | Pacu              | 5   | -  | 5   | 33580; 33698; 33712               |
| <i>Tetragonopterus chalceus</i> Spix and Agassiz, 1829         | Pacu              | 2   | -  | 2   | 33632; 33653                      |
| <i>Triportheus albus</i> Cope, 1872                            | Sardinha          | 1   | -  | 1   | 33654                             |
| <i>Utiaritichthys sennaebregai</i> Miranda Ribeiro, 1937       | Pacu              | 3   | -  | 3   | 33644                             |
| <i>Utiaritichthys</i> sp.                                      | Pacu              | 4   | -  | 4   | 33658; 33670; 33728               |
| Characidae sp.1 (juvenile)                                     | Piaba             | 1   | -  | 1   | 33442                             |
| Characidae sp.2 (juvenile)                                     | Piaba             | 1   | -  | 1   | 33547                             |
| Characidae sp.3 (juvenile)                                     | Piaba             | 3   | -  | 3   | 33013                             |
| Characidae sp.4 (juvenile)                                     | Piaba             | -   | 2  | 2   | 33599                             |
| Characidae sp.5 (juvenile)                                     | Piaba             | 4   | -  | 4   | 33014                             |
| Characidae sp.6 (juvenile)                                     | Piaba             | 1   | -  | 1   | 33012                             |
| Acestrorhynchidae  |                   |     |    |     |                                   |
| <i>Acestrorhynchus falcirostris</i> (Cuvier, 1819)             | Dentudo; Cachorro | 1   | -  | 1   | 33628                             |
| <i>Acestrorhynchus microlepis</i> (Schomburgki, 1841)          | Dentudo; Cachorro | 2   | -  | 2   | 33629; 33724                      |
| Cynodontidae   |                   |     |    |     |                                   |
| <i>Hydrolycus scomberoides</i> (Cuvier, 1816)                  | Peixe-cachorro    | 4   | -  | 4   | 33649; 33720                      |
| <i>Rhaphiodon vulpinus</i> Spix and Agassiz, 1829              | Peixe-cachorro    | 1   | -  | 1   | 33620                             |
| Erythrinidae   |                   |     |    |     |                                   |
| <i>Erythrinus erythrinus</i> (Bloch and Schneider, 1801)       | Jeju              | 8   | 12 | 20  | 33555; 33560; 33568; 33581; 33591 |
| <i>Hoplerythrinus unitaeniatus</i> (Agassiz, 1829)             | Jeju              | 6   | -  | 6   | 33538; 33680                      |
| <i>Hoplias malabaricus</i> (Bloch, 1794)                       | Traíra            | 8   | 4  | 12  | 32990; 33511; 33529; 33544; 33593 |





TABLE 2. CONTINUED.

| TAXA   | VULGAR NAME    | G   | R   | T   | INPA LOT #                                      |
|--|----------------|-----|-----|-----|---|
| Lebiasinidae   |                |     |     |     |   |
| <i>Copella nigrofasciata</i> (Meinken, 1952)                           | Lápis          | 36  | 1   | 37  | 32987; 33478; 33490; 33502; 33541; 33595; 33679 |
| <i>Pyrrhulina</i> sp. n.   | Lápis          | 302 | 106 | 408 | 33554; 33561; 33565; 33570; 33579               |
| Ctenoluciidae  |                |     |     |     |   |
| <i>Boulengerella cuvieri</i> (Agassiz, 1829)                           | Bicuda         | 3   | -   | 3   | 33626; 33664                                    |
| <i>Boulengerella maculata</i> (Valenciennes, 1850)                     | Bicuda         | 5   | -   | 5   | 33704   |
| SILURIFORMES   |                |     |     |     |   |
| Cetopsidae   |                |     |     |     |   |
| <i>Helogenes marmoratus</i> Günther, 1863                              | Bagre; Mandi   | 12  | -   | 12  | 33550   |
| Aspredinidae   |                |     |     |     |   |
| <i>Bunocephalus coracoideus</i> (Cope, 1874)                           | Banjo          | 17  | -   | 17  | 33003; 33470; 33485; 33514                      |
| Trichomycteridae   |                |     |     |     |   |
| <i>Ituglanis</i> sp. n.  | Candiru        | 2   | -   | 2   | 33747   |
| <i>Paracanthopoma</i> sp. n.1  | Candiru        | 1   | -   | 1   | 33596   |
| <i>Paracanthopoma</i> sp. n.2  | Candiru        | 36  | -   | 36  | 31566; 33488; 33521; 33525; 33647; 33751        |
| <i>Paravandellia</i> sp. n.  | Candiru        | 1   | -   | 1   | 33648   |
| Callichthyidae   |                |     |     |     |   |
| <i>Callichthys callichthys</i> (Linnaeus, 1758)                        | Tamoatá        | 2   | 4   | 6   | 33539; 33587; 33676                             |
| <i>Corydoras</i> aff. <i>ornatus</i>                                   | Coridora       | 9   | -   | 9   | 32988; 33509; 33577                             |
| <i>Megalechis picta</i> (Müller and Troschel, 1848)                    | Tamoatá        | 4   | -   | 4   | 33005; 33537; 33557; 33677                      |
| Loricariidae   |                |     |     |     |   |
| <i>Ancistrus</i> sp.   | Acari          | 5   | 1   | 6   | 32980; 33441; 33495; 33600                      |
| <i>Farlowella smithi</i> Fowler, 1913                                  | Acari-cachimbo | 14  | -   | 14  | 33004; 33471; 33519; 33528                      |
| <i>Hypoptopoma</i> aff. <i>gulare</i>                                  | Acari; Bodó    | 2   | -   | 2   | 33637   |
| <i>Hypostomus emarginatus</i> Valenciennes, 1840                       | Acari-pedra    | 8   | -   | 8   | 33636; 33666                                    |
| <i>Hypostomus</i> cf. <i>plecostomus</i>                               | Acari; Bodó    | 9   | -   | 9   | 33643; 33663; 33665                             |
| Hypostominae sp.1  | Acari; Bodó    | 2   | -   | 2   | 33016; 33498                                    |
| Hypostominae sp.2  | Acari; Bodó    | 28  | -   | 28  | 33015; 33445; 33496; 33513                      |
| Hypostominae sp.3  | Acari; Bodó    | 37  | -   | 37  | 33017; 33451; 33510                             |
| <i>Lasiancistrus</i> cf. <i>schomburgkii</i>                           | Acari; Bodó    | 1   | -   | 1   | 33646   |
| <i>Loricaria</i> cf. <i>cataphracta</i>                                | Acari-cachimbo | 13  | -   | 13  | 32992; 33444; 33493; 33515; 33655; 33700        |
| <i>Panaque</i> aff. <i>nigrolineatus</i>                               | Acari; Bodó    | 2   | -   | 2   | 33635   |
| <i>Parotocinclus aripuanensis</i> Garavello, 1988                      | Acari; Bodó    | 93  | -   | 93  | 32983; 33449; 33481; 33500                      |
| <i>Peckoltia</i> cf. <i>sabaji</i>                                     | Acari; Bodó    | 2   | -   | 2   | 33641; 33671                                    |
| <i>Pseudancistrus</i> sp.  | Acari; Bodó    | 1   | -   | 1   | 33645   |
| <i>Rineloricaria lanceolata</i> (Günther, 1868)                        | Acari-cachimbo | 5   | -   | 5   | 32979; 33446                                    |
| Heptapteridae  |                |     |     |     |   |
| <i>Mastiglanis asopos</i> Bockmann, 1994                               | Bagre          | 15  | -   | 15  | 33453; 33489; 33507; 33695                      |
| <i>Nemuroglanis furcatus</i> Ribeiro, Pedroza and Rapp Py-Daniel, 2011 | Bagre          | 92  | -   | 92  | 33757; 33758; 33759; 33760; 33761; 33762        |
| <i>Pimelodella</i> sp.   | Mandi          | 1   | -   | 1   | 33691   |
| <i>Rhamdia quelen</i> (Quoy and Gaimard, 1824)                         | Mandi          | 3   | -   | 3   | 33530; 33545                                    |
| Pimelodidae  |                |     |     |     |   |
| <i>Calophysus macropterus</i> (Lichtenstein, 1819)                     | Piracatinga    | 1   | -   | 1   | 33605   |
| <i>Hemisorubim platyrhynchos</i> (Valenciennes, 1840)                  | Braço-de-moça  | 1   | -   | 1   | 33607   |
| <i>Pimelodus blochii</i> Valenciennes, 1840                            | Mandi          | 1   | -   | 1   | 33709   |
| <i>Pimelodus ornatus</i> Kner, 1858                                    | Mandi          | 1   | -   | 1   | 33623   |
| <i>Pimelodus</i> sp.   | Mandi          | 1   | -   | 1   | 33706   |
| <i>Pinirampus pirinampu</i> (Spix and Agassiz, 1829)                   | Piranambu      | 1   | -   | 1   | 33707   |
| Pseudopimelodidae  |                |     |     |     |   |
| <i>Batrochoglanis raninus</i> (Valenciennes, 1840)                     | Mandi; Bagre   | 2   | -   | 2   | 32978; 33484                                    |
| <i>Microglanis poecilus</i> Eigenmann, 1912                            | Mandi; Bagre   | 62  | -   | 62  | 32998; 33468; 33486; 33516                      |



TABLE 2. CONTINUED.

| TAXA   | VULGAR NAME               | G   | R   | T   | INPA LOT #                               |
|--|---------------------------|-----|-----|-----|--|
| Doradidae  |                           |     |     |     |  |
| <i>Acanthodoras cataphractus</i> (Linnaeus, 1758)                | Reco-reco                 | 3   | -   | 3   | 33465; 33540; 33674                      |
| <i>Amblydoras affinis</i> (Kner, 1855)                           | Reco-reco                 | 47  | -   | 47  | 33002; 33461; 33524                      |
| <i>Leptodoras linnelli</i> Eigenmann, 1912                       | Reco-reco                 | 4   | -   | 4   | 33609; 33681; 33711                      |
| Auchenipteridae  |                           |     |     |     |  |
| <i>Ageneiosus inermis</i> (Linnaeus, 1766)                       | Mandubé; Palmito          | 3   | -   | 3   | 33604; 33705                             |
| <i>Ageneiosus ucayalensis</i> Castelnau, 1855                    | Mandubé; Palmito          | 1   | -   | 1   | Uncatalogued                             |
| <i>Auchenipterichthys longimanus</i> (Günther, 1864)             | Cangati                   | 4   | -   | 4   | 33603; 33624; 33651                      |
| <i>Auchenipterus ambyiacus</i> Fowler, 1915                      | Mandi                     | 2   | -   | 2   | 33713                                    |
| <i>Trachelyopterus galeatus</i> (Linnaeus, 1766)                 | Cangati                   | 2   | -   | 2   | 33007; 33512                             |
| GYMNOTIFORMES  |                           |     |     |     |  |
| Gymnotidae   |                           |     |     |     |  |
| <i>Gymnotus anguilaris</i> Hoedeman, 1962                        | Saparó; Ituí              | 10  | 1   | 11  | 33473; 33494; 33552; 33589               |
| <i>Gymnotus pedanopterus</i> Mago-Leccia, 1994                   | Saparó; Ituí              | -   | 5   | 5   | 33586                                    |
| <i>Gymnotus</i> sp.  | Saparó; Ituí              | 1   | -   | 1   | 33549                                    |
| Sternopygidae  |                           |     |     |     |  |
| <i>Eigenmannia</i> aff. <i>macrops</i>                           | Saparó; Ituí              | -   | 1   | 1   | 33594                                    |
| <i>Eigenmannia limbata</i> (Schreiner and Miranda Ribeiro, 1903) | Saparó; Ituí              | 1   | -   | 1   | 33682                                    |
| <i>Sternopygus</i> aff. <i>castroi</i>                           | Saparó; Ituí              | -   | 2   | 2   | 33597                                    |
| Rhamphichthyidae   |                           |     |     |     |  |
| <i>Gymnorhamphichthys rondoni</i> (Miranda Ribeiro, 1920)        | Ituí-da-areia             | 93  | -   | 93  | 33001; 33472; 33506; 33527; 33684        |
| Hypopomidae  |                           |     |     |     |  |
| <i>Hypopygus lepturus</i> Hoedeman, 1962                         | Saparó; Ituí              | 9   | -   | 9   | 33447                                    |
| Apteronotidae  |                           |     |     |     |  |
| <i>Platyurosternarchus macrostomus</i> (Günther, 1870)           | Saparó; Ituí              | 1   | -   | 1   | 33006                                    |
| CYPRINODONTIFORMES   |                           |     |     |     |  |
| Rivulidae  |                           |     |     |     |  |
| <i>Rivulus</i> sp.   | -                         | 417 | 372 | 789 | 33562; 33566; 33569                      |
| SYNBRANCHIFORMES   |                           |     |     |     |  |
| Synbranchidae  |                           |     |     |     |  |
| <i>Synbranchus madeirae</i> Rosen and Rumney,1972                | Muçum                     | 13  | 3   | 16  | 32994; 33443; 33501; 33559; 33582; 33583 |
| PERCIFORMES  |                           |     |     |     |  |
| Sciaenidae   |                           |     |     |     |  |
| <i>Pachyurus schomburgkii</i> Günther, 1860                      | Pescada; Corvina          | 1   | -   | 1   | 33640                                    |
| <i>Plagioscion squamosissimus</i> (Heckel, 1840)                 | Pescada; Corvina          | 1   | -   | 1   | 33656                                    |
| Cichlidae  |                           |     |     |     |  |
| <i>Aequidens</i> cf. <i>pallidus</i>                             | Acará                     | 7   | -   | 7   | 33543; 33553; 33673                      |
| <i>Aequidens tetramerus</i> (Heckel, 1840)                       | Acará; Acará-cascudo      | 9   | 56  | 65  | 33462; 33480; 33548; 33563; 33567; 33584 |
| <i>Apistogramma</i> aff. <i>linkei</i>                           | Acarazinho                | 65  | -   | 65  | 32997; 33467; 33482; 33518; 33536; 33678 |
| <i>Cichla monoculus</i> Spix and Agassiz, 1831                   | Tucunaré                  | 5   | -   | 5   | 33606; 33715                             |
| <i>Crenicichla</i> aff. <i>regani</i>                            | Jacundá; Joanelha         | 7   | 3   | 10  | 32981; 33531;33601;                      |
| <i>Crenicichla</i> cf. <i>pellegrini</i>                         | Jacundá; Joanelha         | 5   | -   | 5   | 33479; 33546                             |
| <i>Crenicichla marmorata</i> Pellegrin, 1904                     | Jacundá; Joanelha         | 1   | -   | 1   | 33642                                    |
| <i>Geophagus proximus</i> (Castelnau, 1855)                      | Acaratinga, Acará-rói-rói | 4   | -   | 4   | 33522; 33618; 33714                      |
| <i>Geophagus</i> sp. 1 (juvenile)                                | Acaratinga                | 4   | -   | 4   | 33694; 33729                             |
| <i>Geophagus</i> sp. 2 (juvenile)                                | Acaratinga                | 5   | -   | 5   | 33535                                    |



**TABLE 3.** Values of abundance, richness, diversity (Shannon) and equitability of the sampled points in streams from Guariba and Roosevelt Rivers, Madeira River basin.

| POINT | ABUNDANCE | RICHNESS | DIVERSITY | EQUITABILITY |
|-------|-----------|----------|-----------|--------------|
| 1     | 407       | 43       | 3.94      | 0.73         |
| 2     | 281       | 39       | 4.21      | 0.80         |
| 3     | 277       | 28       | 3.81      | 0.79         |
| 4     | 220       | 30       | 3.65      | 0.74         |
| 8     | 533       | 3        | 1.08      | 0.68         |
| 9     | 164       | 20       | 3.23      | 0.75         |
| 10    | 465       | 5        | 1.15      | 0.49         |
| 11    | 158       | 4        | 0.95      | 0.48         |
| 12    | 43        | 4        | 0.68      | 0.34         |
| 13    | 106       | 14       | 2.57      | 0.67         |

**ACKNOWLEDGMENTS:** We are grateful to André Canto, Marcelo Rocha and Renildo de Oliveira (INPA) for collection assistance and to Renata Frederico for developing the map image. F.R.V.R. benefited from a CNPq/Doctoral scholarship. T.F.F. and W.M.O. benefited from CNPq/Master scholarships. Funding for field work was provided by the Centro de Unidades de Conservação do Estado do Amazonas (CUC)/Secretaria de Meio Ambiente do Amazonas(SDS)/Fundo Brasileiro para a Biodiversidade (FUNBIO).

**LITERATURE CITED**

Buckup, P.A. 1993. Review of the characidiini fishes (Teleostei: Characiformes) with descriptions of four new genera and ten new species. *Ichthyological Exploration Freshwaters* 4(2): 97-154.

Buckup, P.A., N.A. Menezes and M.S. Ghazzi. 2007. *Catálogo das espécies de peixes de água doce do Brasil*. Rio de Janeiro: Museu Nacional. 195 p.

Burgess, W.E. 1989. *An atlas of freshwater and marine catfishes: a preliminary survey of the Siluriformes*. Neptune: TFH Publications. 784 p.

Camargo, M. and T. Giarrizzo. 2007. Fish, Marmelos conservation area (BX044), Madeira River basin, states of Amazonas and Rondônia, Brazil. *Check list* 3(4): 291-296.

Carmassi, A.L., G.R. Rondineli and F.M.S. Braga. 2009. Fish, Passa Cinco stream, Corumbataí river basin, state of São Paulo, Brazil. *Check list* 5(1): 112-117.

Casatti, L. 2005. Fish assemblage structure in a first order stream, southeastern Brazil: longitudinal distribution, seasonality, and microhabitat diversity. *Biota Neotropica* 5(1): 2-9.

Cox-Fernandes, C., J. Podos and J.G. Lundberg. 2004. Amazonian ecology: tributaries enhance the diversity of electric fishes. *Science* 305: 1960-1962.

Ferraris, C.J. 2007. Checklist of catfishes, recent and fossil (Osteichthyes: Siluriformes), and catalogue of siluriform primary types. *Zootaxa* 1418: 1-628.

Ferreira, E.J., J.A.S. Zuanon and G.M. Santos. 1998. Peixes comerciais do médio Amazonas, região de Santarém – Pa. Brasília: Edições IBAMA. 211 p.

Garutti, V. 1988. Distribuição longitudinal da ictiofauna em um córrego da região noroeste do estado de São Paulo, bacia do rio Paraná. *Revista Brasileira de Biologia* 48(4):747-759.

Géry, J. 1977. *Characoids of the World*. New Jersey: TFH Publications. 772 p.

Glaser, U., F. Schaefer and W. Glaser. 1996. *Southamerican Cichlids III*. Verlag: A.C.S. GmbH. 144 p.

Isbrücker, I.J.H. 1981. Revision of *Loricaria* Linnaeus, 1758 (Pisces, Siluriformes, Loricariidae). *Beaufortia* 31(3): 51-96.

Kullander, S.O. and H. Nijssen. 1989. *The Cichlids of Surinam*. Leiden: E.J. Brill. 256 p.

Lauzanne, L. and G. Loubens. 1985. *Peces del rio Mamoré*. Paris: Éditions L'Orstom. 116 p.

Lowe-McConnell, R.H. 1987. *Ecological studies in Tropical Fish Communities*. Cambridge: Cambridge University. 382 p.

Lundberg, J.G., W.M. Lewis Jr., J.F. Saunders III and F. Mago-Leccia. 1987. A major food web component in the Orinoco River Channel: evidence from planktivorous electric fishes. *Science* 237:81-83.

Mago-Leccia, F. 1994. *Electric fishes of the continental waters of America*. *Electric fishes of the continental waters of America*. Caracas: Fundación para el Desarrollo de las Ciencias Fisicas, Matematicas y Naturales. 206 p.

Pielou, J. 1966. The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology* 13: 131-144.

Projeto Igarapés 2007. *Metodologia utilizada para coletas em igarapés de 1ª e 2ª ordens*. Electronic Database accessible at <http://www.igarapés.bio.br/>. Captured on 26 October 2011.

Rapp Py-Daniel, L., C.P. Deus, O.M. Ribeiro and L.M. Sousa. 2007. Peixes; p. 89-125 In L. Rapp Py-Daniel, C.P. Deus, A.L. Henriques, D.M. Pimpão and O.M. Ribeiro (ed.). *Biodiversidade do Médio Madeira: Bases científicas para propostas de conservação*. INPA: Manaus. 244 p.

Reis, R.E. 1997. Revision of the Neotropical catfish genus *Hoplosternum* (Ostariophysi: Siluriformes: Callichthyidae), with the description of two new genera and three new species. *Ichthyological Exploration of Freshwaters* 7(4): 299-326.

Reis, R.E., S.O. Kullander and C.J. Ferraris. 2003. *Check List of the Freshwater Fishes of South and Central America*. Porto Alegre: Edipucrs. 729 p.

Santos, G.M. and E.J. Ferreira. 1999. Peixes da bacia Amazônica; p. 345-354 In R.H. Lowe-McConnell (ed.). *Estudos ecológicos de comunidades de peixes tropicais*. São Paulo: Edusp.

Santos, G.M., B. Merona, A.A. Juras and M. Jégu. 2004. *Peixes do Baixo Rio Tocantins: 20 anos depois da Usina Hidrelétrica Tucuruí*. Brasília: Eletronorte. 216 p.

Shannon, C.E. and W. Weaver, 1963. *The mathematical theory of communication*. Urbana: Illinois University Press. 177p.

Vari, R.P. 1983. Phylogenetic relationships of the families Curimatidae, Prochilodontidae, Anostomidae and Chilodontidae (Pisces, Characiformes). *Smithsonian Contribution to Zoology* 378: 1-60.

Vari, R.P. 1989. Systematics of the neotropical Characiform Genus *Psectrogaster* Eigenmann and Eigenmann (Pisces: Characiformes). *Smithsonian Contribution to Zoology* 481: 1-43.

Zanata, A.M. and R.P. Vari. 2005. The family Alestidae (Ostariophysi, Characiformes): a phylogenetic analysis of a trans-Atlantic clade. *Zoological Journal of the Linnean Society* 145: 1-144.

RECEIVED: April 2010  
ACCEPTED: November 2011  
PUBLISHED ONLINE: February 2012  
EDITORIAL RESPONSIBILITY: Marcelo Loureiro